The Quarterly Review Of Interest Rate Risk

Fourth Quarter Sees Rise in Sensitivity

Median thrift sensitivity rose to 190 basis points in the fourth quarter, up from 177 basis points in September. This increase reflects the rise in medium– and long-term interest rates between the third and fourth quarters.

Both the median pre– and post-shock Net Portfolio Value (NPV) ratios rose between the third and fourth quarters. In addition, the fourth quarter saw the number of thrifts with high interest rate risk rise to 21, up from 15 thrifts in the previous quarter.

Interest Rate Sensitivity Measure
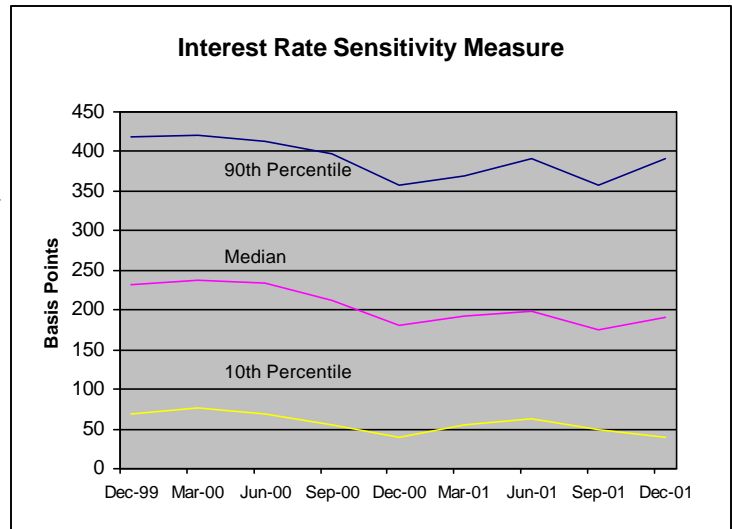
See details inside, starting on page 3.

Special points of interest:

- Fourth quarter sees Interest rate sensitivity rise
- Yield curve becomes more steeply sloped
- Spot and Forward Rates in the NPV Model
- Median pre– and post-shock NPV ratios rise
- 30-Yr Mortgage rate rises
- Self-Reporting of Mortgage Derivatives on Schedule CMR

Spot and Forward Rates in the NPV Model

Thrifts hold a wide variety of assets and liabilities in their portfolios. Despite obvious differences, all of these financial instruments have one important feature in common: their fair market values are equal to the present discounted values of the cash flows that occur over the lifetime of the instruments.

An important question arises as to what is the appropriate interest rate to use in discounting the cash flows. In deciding which discount rate to use for an asset, say a bond, it is important to take into account the characteristics of that bond. For example, is the bond a zero-coupon or a coupon bond?

Because Treasury securities have no credit risk, the rates on these instruments serve as benchmark rates with which to compare the rates of other financial instruments that contain credit risk. Thus, while the following discussion focuses on Treasury rates, it can easily be generalized through the incorporation of credit spreads.

The NPV Model uses Treasury spot and implied forward rates to produce present value estimates of Treasury securities. Securities other than Treasuries are valued using spot and forward rates where spreads are added to account for different levels of credit risk.

In order to understand spot and forward interest rates, we need to define two other relevant interest rates: yield to maturity (YTM) and constant maturity Treasury (CMT) rates.

Yield to maturity, also known as effective rate of return, is the annualized percentage return of a non-callable bond held until its stated maturity. In using this yield measure, one assumes that the security is held until maturity and that all cash flows can be reinvested at the same constant YTM. With this rate measure, it is important to note that all cash flows associated with the bond are discounted at the same

Spot and Forward Rates in the NPV Model (continued)

(Continued from page 1)
rate.

Several drawbacks are associated with the use of yield to maturity: Investors typically do not hold fixed-income investments until maturity; interim cash flows cannot usually be re-invested at the assumed constant yield; and it is not possible to compare returns on investments with different maturities, different coupons, and more complex return/risk profiles.

Constant maturity Treasury rates are yields to maturity produced by the U.S. Treasury from the daily Treasury yield curve. The constant maturity Treasury yields are calculated based on the closing market bids on actively traded Treasury securities in the over-the-counter market. As the name implies, these rates are for a given set of fixed, or constant, maturities. That is, as rate schedules are published over time, the underlying securities must be changed such that their time remaining to maturity most precisely concords with the time frames for which the rates are being quoted.

Because constant maturity Treasury rates are yields to maturity, the drawbacks discussed above apply to their use. When discussing the Treasury yield curve, it should be noted that the rates depicted in the curve are yields that are constant maturity Treasury yields.

By definition, the **spot rate** for a particular maturity is the yield on a zero-coupon bond with that maturity. For example, the two-year spot Treasury rate is the yield on a zero-coupon Treasury with a two-year maturity.

The spot rate curve is the graphical representation of the spot rates corresponding to various maturities. The Treasury spot rate will only be identical to the actual yield for discount Treasury securities, such as the 3 and 6 month Treasury bills. The complete theoretical spot rate curve, however, must be derived from the yields on Treasury bills, as well as coupon-paying Treasury bonds.

Bootstrapping is the standard technique used to construct the theoretical Treasury spot-rate curve from observed yields on both Treasury bills and bonds. The basic principle underlying this approach is that the cash flows on a coupon-bond can be viewed as a series of zero-coupon or discount bonds for each coupon payment and maturity date. Thus, the value of a Treasury coupon security for a given maturity is equal to the value of the series of zero-coupon Treasury securities that reproduces the coupon bond's cash flows.

The NPV Model uses the bootstrapping approach to construct Treasury spot rates. These spot rates are reported for selected maturities at the end of each quarter by OTS in the Asset/Liability Price Tables published on its website.

Forward rates are the market's expectation as to what the spot rate will be at a particular point in the future. Because forward rates are derived from the spot rate curve under the assumption of no arbitrage (i.e., riskless profits can not be earned), they are usually referred to as **implied forward rates**. For example, the expected yield on a three-month Treasury bill three months from now is called an implied forward rate. That is, it is the expected rate for this particular future time frame implied by the current spot yield curve. At the end of each quarter, the Asset/Liability Price Tables report implied one-month forward rates for a selected set of maturities.

Based on the rate definitions above, we can now discuss how the NPV Model calculates theoretical spot and implied forward rates, and how these rates are used in asset and liability valuations. This discussion draws on material from "Term Structures and Projected Interest Rates," Chapter 8, *The OTS Net Portfolio Model.*

To begin the process, data on constant maturity Treasury rates are obtained from *Federal Reserve Statistical Release*, H.15 (previously obtained from G.13). The maturities for which these yields are available are 1, 3, and 6 months, and 1, 2, 3, 5, 7, 10, 20, and 30 years. Because the NPV Model requires monthly market yields going out 360 months, an estimation method known as "splining" is used to produce estimates of yields for maturities with no available market quotes.

Once a full set of 360 CMTs is obtained, the NPV Model uses the bootstrapping technique to generate the theoretical spot-rate curve for the base case scenario, whose estimation is based on having different spot rates for each and every month, going out 360 months.

Questions arise each quarter as to why the spot-rate curve produced by the NPV Model and the spot-rate curve obtained from Bloomberg differ, even though both curves are bootstrapped. The spot-rate estimates differ because the splining or smoothing techniques are not identical.

Given the spot-rate curve bootstrapped from the constant maturity Treasuries, the NPV Model calculates implied one-month forward rates. For example, the implied one-month forward rate in month 24 is calculated based on the 24– and 25-month theoretical spot rates. These one month implied forward rates are rates that the market expects to prevail in the future for one-month time horizons.

At the end of each quarter, the NPV Model also generates term structure estimates and projected future rates for LIBOR, FHLB Advances, and retail and secondary market CD rates using the same methods described above. The foregoing discussion focuses on Treasury spot and forward rates, since these are the areas most closely watched by users of the NPV Model results.

It is hoped that this discussion will help to promote a better understanding of the rates used by the NPV Model, how they are defined, and how they are calculated.

Interest Rates and ARM Market Share

Interest Rates

Yield Curves

ARM Market Share of Originations

ARM Share of Thrift Mortgage Portfolios
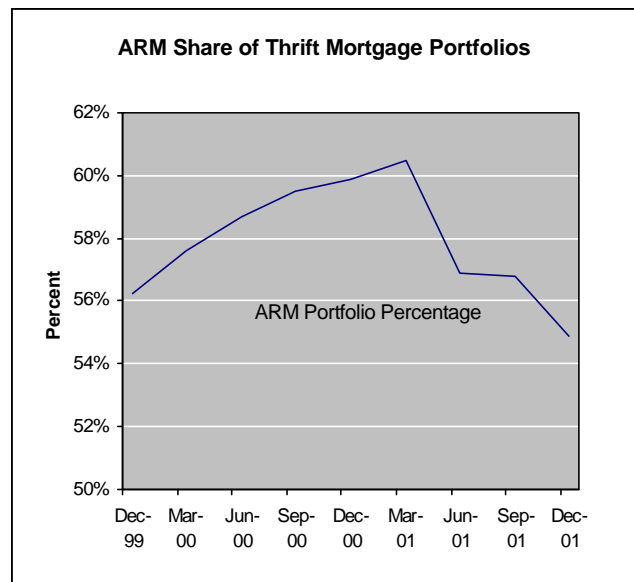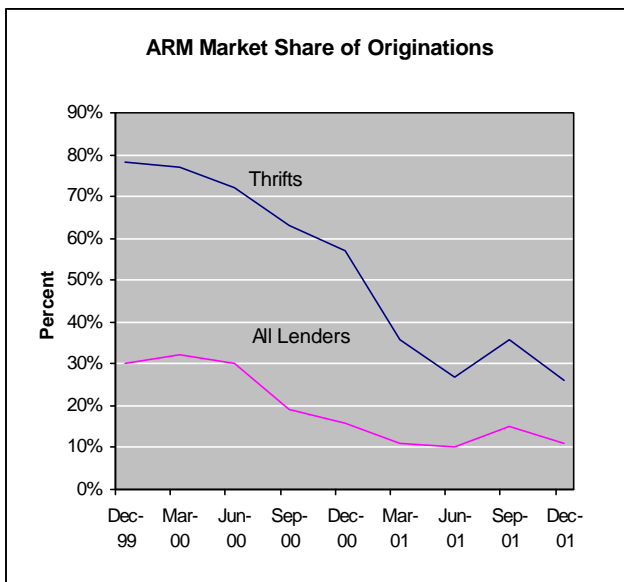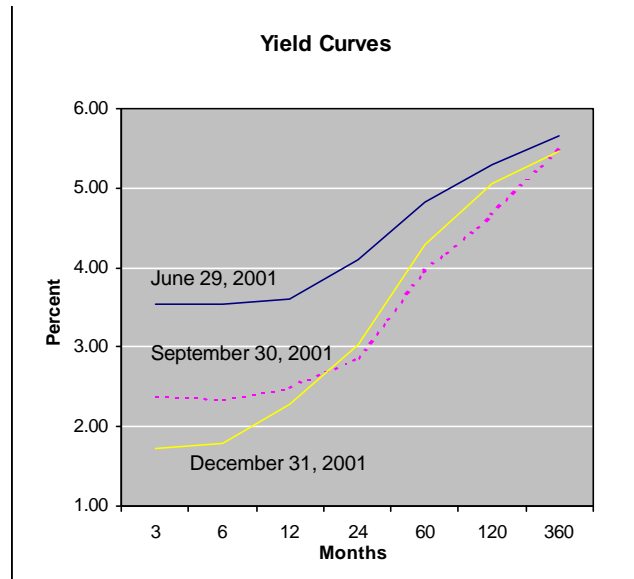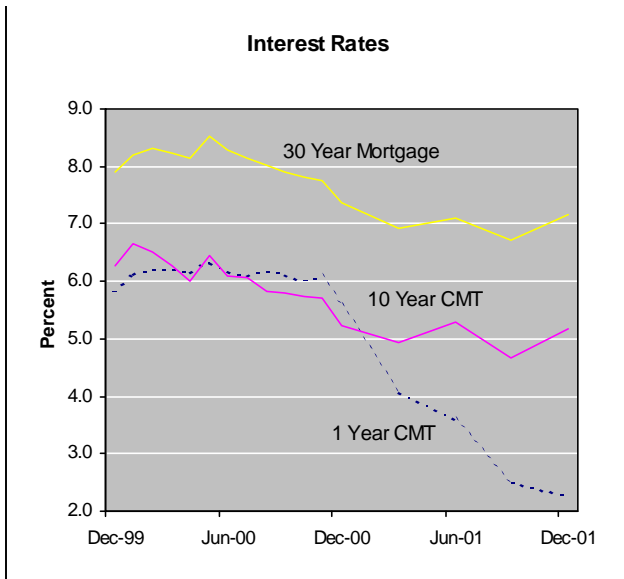
(Continued from page 1)

Medium– and long-term Treasury rates rose, while rates on Treasuries with maturities less than two years fell, between the third and fourth quarters. In addition, the 30-year mortgage rate rose to 7.16 percent at the end of the fourth quarter.

The changes in interest rates between the third and fourth quarters created a favorable lending environment for the typical thrift. As a result of a more steeply sloped yield curve, thrifts saw their net interest margins rise. For example,

the industry's average net interest margin improved to 312 basis points in the third quarter, up from 294 basis points in the prior quarter.

The ARM share of total thrift mortgage originations fell to 26 percent, down from 36 percent in the prior quarter. Along with the relative fall in ARM originations, the share of ARM mortgages held in portfolio fell to 54.9 percent in the fourth quarter.

The fourth quarter saw a rebound in mortgage originations after easing in the third quarter

due to delays in loan settlement for a short period of time following the September 11 terrorist attacks. Fourth-quarter 1-4 family mortgage originations by thrifts stood at $110.4 billion, up six percent from $103.8 billion in the third quarter. Total mortgage originations in the fourth quarter were at a level of $124.2 billion, up from $118.7 billion in the third quarter.

Thrifts' share of all 1-4 family originations was 17 percent in the fourth quarter, down from 23.4 percent in the third quarter. The

Duration and NPV Sensitivity Measures

Average Effective Duration

Median Pre- and Post-Shock NPV Ratios

Estmated Change in NPV:
+200bp Rate Change

Estimated Change in NPV:
-100bp Rate Change
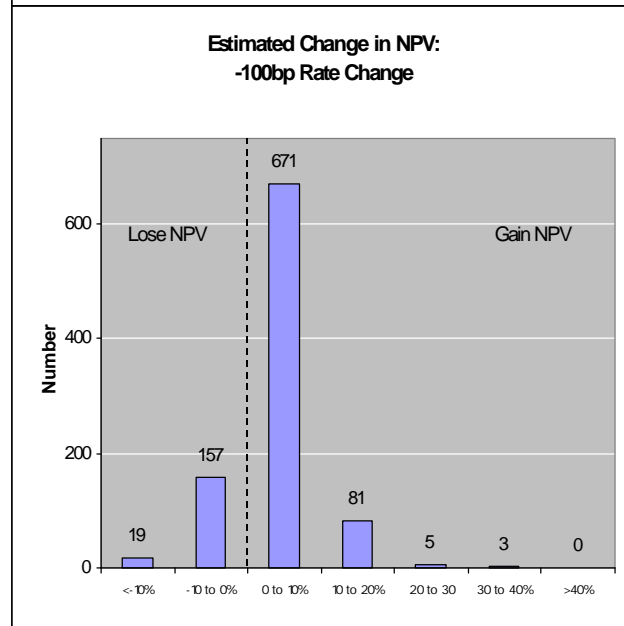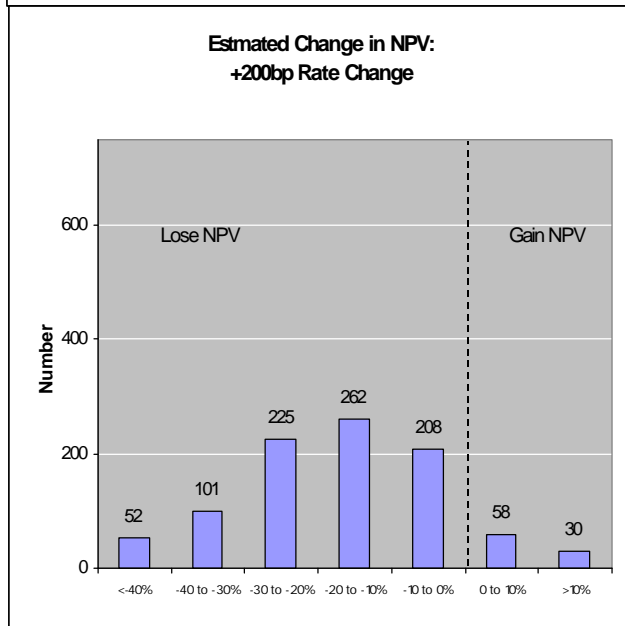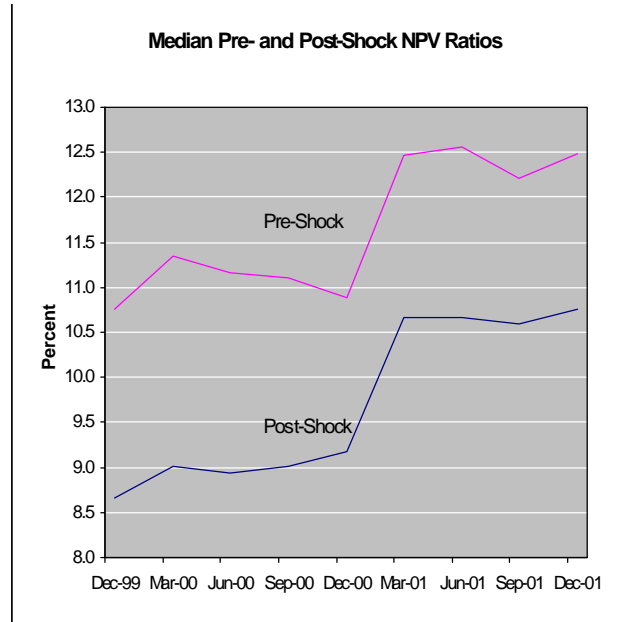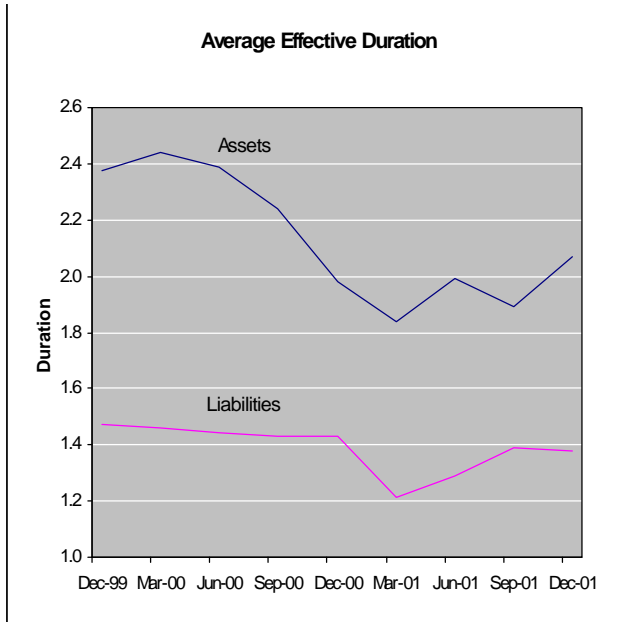
(Continued from page 3)

fourth quarter witnessed a slight decrease in U.S. home ownership, falling to 68 percent from 68.1 percent by quarter-end.

Refinancing activity of all mortgages accounted for 41 percent of thrift originations in the fourth quarter, up sharply from 28.8 percent in the third quarter. This increase is consistent with the mortgage refinancing activity of all lenders, with the rate rising dramatically to 70 percent in the fourth quarter, up from 45 percent in the prior quarter.

Fourth-quarter earnings rose to a new record of $2.93 billion, up from $2.61 billion in the third quarter.

The industry's average effective duration of assets rose from 1.89 to 2.07 between the third and fourth quarters, due to the rise in interest rates. As rates rise, the NPV Model yields a decrease in the predicted rate of mortgage prepayments. This decrease in the predicted rate of mortgage prepayments causes, in turn, increases in the durations of mortgage assets.

The industry's average effective duration of liabilities fell slightly to 1.38 in the fourth quarter, down from 1.39 in the prior quarter.

The median pre-shock NPV ratio for the industry rose from 12.2 percent to 12.5 percent between the third and fourth quarters.

The median post-shock NPV ratio rose to 10.8 percent in the fourth quarter, up from 10.6 percent in the prior quarter.
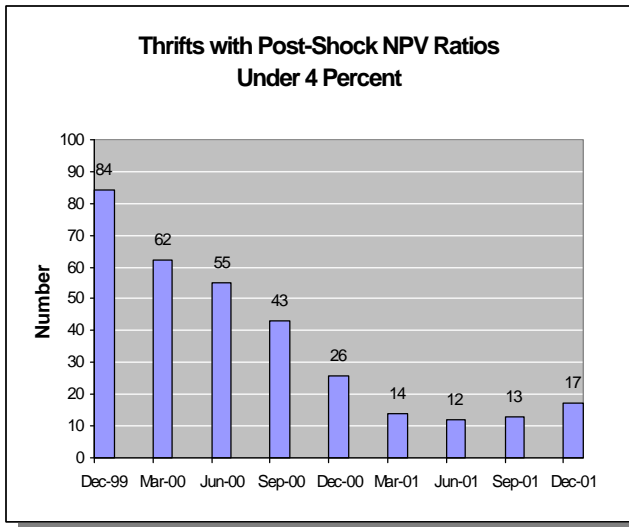
Interest Rate Risk Measures

Thrifts with Post-Shock NPV Ratios Under 4 Percent

Interest Rate Risk Measures Industry Aggregates Last Two Quarters

	Ratio of NPV to Assets		% Change	% Change
	Sep-01	**Dec-01**	**Sep-01**	**Dec-01**
+300	8.1	8.2	-26%	-25%
+200	9.3	9.1	-14%	-15%
+100	10	9.9	-8%	-6%
Base	10.5	10.3	0	0
-100	10.5	10.4	1%	2%
-200	10.5	N/A	2%	N/A
-300	N/A	N/A	N/A	N/A

Post-Shock NPV Ratio and Sensitivity Measure Matrix September 2001

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	166	167	181	24	538
6% to 10%	90	111	139	19	359
4% to 6%	3	14	23	3	43
Below 4%	0	1	7	5	13
Total	259	293	350	51	953

Minimal	Moderate	Significant	High

Post-Shock NPV Ratio and Sensitivity Measure Matrix December 2001

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	195	118	185	44	542
6% to 10%	88	81	151	25	345
4% to 6%	1	4	19	8	32
Below 4%	2	2	8	5	17
Total	286	205	363	82	936

Minimal	Moderate	Significant	High

(Continued from page 4)

At the end of the fourth quarter, a 200 basis point increase in rates would result in a loss in net portfolio value for 848 thrifts, while 88 thrifts would see their net portfolio values rise. In the event that rates fell by 100 basis points, 760 thrifts would see their net portfolio values rise, while 176 thrifts would see a decrease in their net portfolio values.

The number of thrifts with a post-shock NPV ratio below 4 per-cent rose to 17. This represents the second consecutive quarterly increase in this number.

With a 200 basis point increase in interest rates, the thrift industry would lose 15 percent of its net portfolio value. This net portfolio loss is up only slightly from 14 percent in the previous quarter, and is consistent with the rise in median sensitivity.

The percentage of thrifts with a post-shock NPV ratio over 6 per-cent increased between the third and fourth quarters. In the fourth quarter, the number of such thrifts was 94.8 percent compared to 94.1 percent in the prior quarter.

The number of thrifts with a post-shock NPV ratio below 6 per-cent fell to 49 in the fourth quarter, down from 56 in the third quarter. The number of thrifts with a sensitivity of 200 basis points or less decreased to 491 in the fourth quarter, down from 552 in the third quarter.

The number of thrifts with over 400 basis points in sensitivity rose to 82 in the fourth quarter, up sharply from 51 in the third quarter. The rise in medium– and long-term interest rates led to the aforementioned increase in the number of thrifts with high interest rate risk from 15 to 21 between the third and fourth quarters.

Due to the abnormally low short term interest rates prevailing at the end of the fourth quarter of 2001, the rate shocks for producing sensitivities and post-shock NPVs were modified from +/-200 bps to +200/-100 bps. For this reason, the reader should exercise caution in making comparisons in the interest rate risk measures between the third and fourth quarters.

CMR Reporting of Mortgage Derivatives

Beginning with the March 2002 reporting cycle, thrifts must provide market value estimates for all their mortgage derivatives on Schedule CMR. This reporting change means that market values need to be supplied for both high and low risk mortgage derivatives.

Using contract code 123 from Appendix D, *Thrift Financial Report Instruction Manual*, the market values of all mortgage derivatives are now reported on the "Supplemental Reporting of Market Value Estimates" page of CMR. This change will produce more accurate NPV estimates.

Economic Analysis
Division

Glossary

Pre-Shock NPV Ratio: Equity-to-assets expressed in present value terms (i.e., base case NPV divided by base case present value of assets).

Post-Shock NPV Ratio: Equity-to-assets ratio, following an adverse 200 basis point interest rate shock (assuming a normal interest rate environment), expressed in present value terms (i.e., post-shock NPV divided by post-shock present value of assets). Also referred to as the exposure ratio.

Sensitivity Measure: The difference between Pre-shock and Post– shock NPV Ratios (expressed in basis points).

Estimated Change in NPV: The percentage change in base case NPV caused by an interest rate shock.

Duration: A measure of the price sensitivity of a financial instrument to changes in yield. The higher the duration, the greater the price sensitivity. For example, an asset with duration of 1.6 will appreciate in value by about 1.6 percent for one percentage point (100 basis points) decline in yield.

NPV Model: Measures how six hypothetical changes in interest rates (three successive 100 basis point increases and three successive 100 basis point decreases, assuming a normal interest rate environment) affect the estimated market value of a thrift's net worth.

Kurtosis: A statistical measure of the tendency of data to be distributed toward the tails, or ends, of the distribution. A normal distribution has a kurtosis statistic of 0.

Skewness: A statistical measure of the degree to which a distribution is more spread out on one side than the other. A distribution that is approximately symmetric will have a skewness statistic close to 0.

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Appendix A — All Thrifts

Sensitivity Measure Distribution
All Thrifts

Percent of Thrifts

Descriptive Statistics
Median = 190
Mean = 203
Standard Deviation = 137
Skewness = 0.6
Kurtosis = -0.2
Maximum = 707
Minimum = 0
Count = 936

Basis Points

Pre-Shock NPV Ratio Distribution
All Thrifts

Percent of Thrifts

Descriptive Statistics
Median = 12.49
Mean = 14.29
Standard Deviation = 7.66
Skewness = 4.85
Kurtosis = 34.14
Maximum = 85.84
Minimum = 3.12
Count = 936

NPV Ratio (Percent)

Post-Shock NPV Distribution
All Thrifts

Percent of Thrifts

Descriptive Statistics
Median = 10.76
Mean = 12.26
Standard Deviation = 7.7
Skewness = 5
Kurtosis = 36.2
Maximum = 85.65
Minimum = 0.08
Count = 936

NPV Ratio (Percent)

Asset Duration Distribution
All Thrifts

Percent of Thrifts

Descriptive Statistics
Median = 2.07
Mean = 2.06
Standard Deviation = 0.76
Skewness = -0.1
Kurtosis = 2.18
Maximum = 6.09
Minimum = -2.22
Count = 936

Duration

Liabilities Duration Distribution
All Thrifts

Percent of Thrifts

Descriptive Statistics
Median = 1.38
Mean = 1.39
Standard Deviation = 0.38
Skewness = 0.44
Kurtosis = 3.94
Maximum = 4.06
Minimum = -0.39
Count = 936

Duration

Appendix B – Northeast Region

Sensitivity Measure Distribution
Northeast

Percent of Thrifts

Descriptive Statistics
Median = 265
Mean = 256
Standard Deviation = 120
Skewness = -0.05
Kurtosis = -0.55
Maximum = 532
Minimum = 20
Count = 196

Basis Points

Pre-Shock NPV Ratio Distribution
Northeast

Percent of Thrifts

Descriptive Statistics
Median = 13.21
Mean = 15.31
Standard Deviation = 8.85
Skewness = 4.64
Kurtosis = 28.43
Maximum = 80.54
Minimum = 4.56
Count = 196

NPV Ratio (Percent)

Post-Shock NPV Distribution
Northeast

Percent of Thrifts

Descriptive Statistics
Median = 11.01
Mean = 12.75
Standard Deviation = 9.11
Skewness = 4.66
Kurtosis = 28.73
Maximum = 80.25
Minimum = 2.84
Count = 196

NPV Ratio (Percent)

Asset Duration Distribution
Northeast

Percent of Thrifts

Descriptive Statistics
Median = 2.37
Mean = 2.37
Standard Deviation = 0.67
Skewness = -0.89
Kurtosis = 3.44
Maximum = 4.08
Minimum = -1.09
Count = 196

Duration

Liabilities Duration Distribution
Northeast

Percent of Thrifts

Descriptive Statistics
Median = 1.49
Mean = 1.51
Standard Deviation = 0.33
Skewness = 0.25
Kurtosis = 0.04
Maximum = 2.43
Minimum = 0.68
Count = 196

Duration

Appendix C — Southeast Region

Sensitivity Measure Distribution
Southeast

Percent of Thrifts

Basis Points

Descriptive Statistics
Median = 164
Mean = 200
Standard Deviation = 152
Skewness = 0.82
Kurtosis = -0.11
Maximum = 668
Minimum = 7
Count = 182

Pre-Shock NPV Ratio Distribution
Southeast

Percent of Thrifts

NPV Ratio (Percent)

Descriptive Statistics
Median = 12.26
Mean = 13.51
Standard Deviation = 4.66
Skewness = 1.03
Kurtosis = 0.9
Maximum = 29.95
Minimum = 4.48
Count = 182

Post-Shock NPV Distribution
Southeast

Percent of Thrifts

NPV Ratio (Percent)

Descriptive Statistics
Median = 10.35
Mean = 11.5
Standard Deviation = 4.65
Skewness = 0.78
Kurtosis = 0.68
Maximum = 26.16
Minimum = 1.59
Count = 182

Asset Duration Distribution
Southeast

Percent of Thrifts

Duration

Descriptive Statistics
Median = 1.86
Mean = 2.02
Standard Deviation = 0.79
Skewness = 0.35
Kurtosis = -0.28
Maximum = 4.4
Minimum = 0.29
Count = 182

Liabilities Duration Distribution
Southeast

Percent of Thrifts

Duration

Descriptive Statistics
Median = 1.32
Mean = 1.33
Standard Deviation = 0.38
Skewness = -0.27
Kurtosis = 1.88
Maximum = 2.41
Minimum = -0.39
Count = 182

Appendix D – Central Region

Sensitivity Measure Distribution
Central

Percent of Thrifts

Descriptive Statistics
Median = 213
Mean = 214
Standard Deviation = 131
Skewness = 0.49
Kurtosis = -0.01
Maximum = 652
Minimum = 12
Count = 279

Basis Points

Pre-Shock NPV Ratio Distribution
Central

Percent of Thrifts

Descriptive Statistics
Median = 13.25
Mean = 14.46
Standard Deviation = 6.55
Skewness = 3.44
Kurtosis = 19.07
Maximum = 62
Minimum = 4.37
Count = 279

NPV Ratio (Percent)

Post-Shock NPV Distribution
Central

Percent of Thrifts

Descriptive Statistics
Median = 11.16
Mean = 12.32
Standard Deviation = 6.51
Skewness = 3.56
Kurtosis = 20.58
Maximum = 59.97
Minimum = 0.08
Count = 279

NPV Ratio (Percent)

Asset Duration Distribution
Central

Percent of Thrifts

Descriptive Statistics
Median = 2.15
Mean = 2.13
Standard Deviation = 0.74
Skewness = 0.03
Kurtosis = 4.99
Maximum = 6.09
Minimum = -1.77
Count = 279

Duration

Liabilities Duration Distribution
Central

Percent of Thrifts

Descriptive Statistics
Median = 1.38
Mean = 1.4
Standard Deviation = 0.35
Skewness = 0.49
Kurtosis = 3.42
Maximum = 2.84
Minimum = 0.03
Count = 279

Duration

Appendix E — Midwest Region

Sensitivity Measure Distribution
Midwest

Percent of Thrifts

Descriptive Statistics
Median = 110
Mean = 151
Standard Deviation = 122
Skewness = 1.05
Kurtosis = 0.32
Maximum = 533
Minimum = 0
Count = 204

Basis Points

Pre-Shock NPV Ratio Distribution
Midwest

Percent of Thrifts

Descriptive Statistics
Median = 11.88
Mean = 13.89
Standard Deviation = 9.17
Skewness = 5.53
Kurtosis = 36.92
Maximum = 85.84
Minimum = 3.12
Count = 204

NPV Ratio (Percent)

Post-Shock NPV Distribution
Midwest

Percent of Thrifts

Descriptive Statistics
Median = 10.57
Mean = 12.38
Standard Deviation = 9.17
Skewness = 5.66
Kurtosis = 38.68
Maximum = 85.65
Minimum = 1.05
Count = 204

NPV Ratio (Percent)

Asset Duration Distribution
Midwest

Percent of Thrifts

Descriptive Statistics
Median = 1.7
Mean = 1.8
Standard Deviation = 0.71
Skewness = -0.41
Kurtosis = 4.07
Maximum = 3.52
Minimum = -2.22
Count = 204

Duration

Liabilities Duration Distribution
Midwest

Percent of Thrifts

Descriptive Statistics
Median = 1.36
Mean = 1.39
Standard Deviation = 0.44
Skewness = 1.31
Kurtosis = 7.26
Maximum = 4.06
Minimum = 0.08
Count = 204

Duration

Appendix F — West Region

Sensitivity Measure Distribution
West

Percent of Thrifts

Descriptive Statistics

Median = 133
Mean = 172
Standard Deviation = 143
Skewness = 1.38
Kurtosis = 2.32
Maximum = 707
Minimum = 5
Count = 75

Basis Points

Pre-Shock NPV Ratio Distribution
West

Percent of Thrifts

Descriptive Statistics
Median = 12.32
Mean = 14.03
Standard Deviation = 9.2
Skewness = 4.51
Kurtosis = 25.56
Maximum = 73.94
Minimum = 6.9
Count = 75

NPV Ratio (Percent)

Post-Shock NPV Distribution
West

Percent of Thrifts

Descriptive Statistics
Median = 10.6
Mean = 12.31
Standard Deviation = 9.22
Skewness = 4.65
Kurtosis = 26.56
Maximum = 72.75
Minimum = 4.05
Count = 75

NPV Ratio (Percent)

Asset Duration Distribution
West

Percent of Thrifts

Descriptive Statistics
Median = 1.73
Mean = 1.85
Standard Deviation = 0.79
Skewness = 0.54
Kurtosis = 0.52
Maximum = 4.02
Minimum = 0.11
Count = 75

Duration

Liabilities Duration Distribution
West

Percent of Thrifts

Descriptive Statistics
Median = 1.27
Mean = 1.24
Standard Deviation = 0.39
Skewness = -0.2
Kurtosis = 1.5
Maximum = 2.24
Minimum = 0.04
Count = 75

Duration